

WHAT IS CLAIMED IS:

1 [C1] 1. A digital image system capable of receiving digital image data representing at
2 least part of a digital image and mapping said digital image data onto the range of an output
3 device, said digital image system comprising:

4 an image statistics processor capable of calculating at least one current image
5 statistic based on said digital image data;

6 calculation logic connected to receive said at least one current image statistic
7 from said image statistics processor and further being capable of calculating at least one tone
8 curve parameter based on said at least one current image statistic and at least one perceptual
9 preference associated with said digital image system; and

10 a tone curve generator connected to receive said at least one tone curve
11 parameter from said calculation logic and further being capable of generating a tone curve
12 using said at least one tone curve parameter and a sigmoidal function, said tone curve being
13 used to map said digital image data onto the range of said output device.

1 [C2] 2. The system of Claim 1, further comprising:

2 a linear transformation device connected to receive said digital image data,
3 convert said digital image data into linear image data and transmit said linear image data to
4 said image statistics processor, said image statistics processor using said linear image data in
5 calculating said at least one current image statistic.

1 [C3] 3. The system of Claim 2, wherein said image statistics processor comprises:
2 a histogram generator connected to receive said linear image data and generate
3 a histogram of the pixel values represented by said linear image data, said histogram
4 containing a plurality of bins representing respective ranges of pixel values and a count of the
5 number of pixel values represented by said linear image data within each of said plurality of
6 bins;
7 a converter capable of converting a bin center value for each of said bins
8 associated with said histogram from a linear scale to an L^* scale to produce a plurality of L^*
9 bin center values; and
10 statistics calculation logic connected to receive said count from said histogram
11 generator and said plurality of L^* bin center values from said converter and calculate said at
12 least one current image statistic using said count and said plurality of L^* bin center values.

1 [C3] 4. The system of Claim 3, further comprising:
2 a memory for storing said plurality of L^* bin center values prior to said
3 histogram being generated, said statistics calculation logic retrieving said plurality of L^* bin
4 center values in response to receiving said count.

1 [C5] 5. The system of Claim 1, wherein said at least one tone curve parameter includes
2 a slope parameter and a shift parameter and wherein said at least one current image statistic

3 includes a current L^* standard deviation and one of a current mean L^* value or low and high
4 L^* percentile values.

1 [C6] 6. The system of Claim 5, wherein said at least one perceptual preference includes
2 a desired L^* standard deviation and one of a desired mean L^* value or a centering function,
3 said slope parameter being calculated using said current L^* standard deviation and said
4 desired L^* standard deviation, said shift parameter being calculated using either said current
5 mean L^* value and said desired mean L^* value or said low and high L^* percentile values
6 and said centering function.

1 [C7] 7. The system of Claim 6, further comprising:
2 an upper pre-selected mean L^* value and an associated upper pre-selected
3 shift value, said shift parameter being set to said upper pre-selected shift value when said
4 current mean L^* value is less than said upper pre-selected mean L^* value and said calculated
5 shift parameter is less than said upper pre-selected shift value; and
6 a lower pre-selected mean L^* value and an associated lower pre-selected shift
7 value, said shift parameter being set to said lower pre-selected shift value when said current
8 mean L^* value is greater than said lower pre-selected mean L^* value and said calculated
9 shift parameter is greater than said lower pre-selected shift value.

1 [C8] 8. The system of Claim 5, further comprising a memory for storing first and
2 second pre-calculated tone curves generated by said tone curve generator prior to said digital
3 image system receiving said digital image data, said first pre-calculated tone curve having a
4 minimum slope and said second pre-calculated tone curve having a maximum slope.

1 [C9] 9. The system of Claim 8, wherein said tone curve generator comprises:
2 calculation logic connected to receive said slope parameter and said first and
3 second pre-calculated tone curves, said calculation logic being further capable of interpolating
4 between said first and second pre-calculated tone curves using said slope parameter to obtain
5 an initial tone curve; and
6 shifting logic connected to receive said initial tone curve and said shift
7 parameter, said shifting logic being further capable of shifting said initial tone curve on the X-
8 axis using said shift parameter to produce said tone curve used in mapping said digital image
9 data onto the range of said output device.

1 [C10] 10. The system of Claim 1, wherein said tone curve generator further comprises:
2 gamma correction logic for applying gamma correction to the Y-axis of said
3 tone curve; and
4 a converter for converting the X-axis of said tone curve to the scale of said
5 digital image data.

1 [C11] 11. A method for mapping digital image data representing at least part of a digital
2 image onto the range of an output device, said method comprising:
3 receiving said digital image data at a digital image system;
4 calculating at least one current image statistic based on said digital image data;
5 calculating at least one tone curve parameter based on said at least one current
6 image statistic and at least one perceptual preference; and
7 generating a tone curve using said at least one tone curve parameter and a
8 sigmoidal function, and using said tone curve to map said digital image data onto the range of
9 said output device.

1 [C12] 12. The method of Claim 11, wherein said step of calculating said at least one
2 current image statistic further comprises:
3 converting said digital image data into linear image data; and
4 calculating said at least one current image statistic using said linear image data.

1 [C13] 13. The method of Claim 12, wherein calculating said at least one current image
2 statistic further comprises:
3 generating a histogram of the pixel values represented by said linear image
4 data, said histogram containing a plurality of bins representing respective ranges of pixel
5 values and a count of the number of pixel values represented by said linear image data within
6 each of said plurality of bins;
7 converting a bin center value for each of said bins associated with said
8 histogram from a linear scale to an L^* scale to produce a plurality of L^* bin center values;
9 and
10 calculating said at least one current image statistic using said count and said
11 plurality of L^* bin center values.

1 [C14] 14. The method of Claim 13, wherein converting said bin centers further
2 comprises:
3 converting said bin center values to produce a plurality of L^* bin center values
4 prior to said step of generating; and
5 storing said plurality of L^* bin center values within a memory.

1 [C15] 15. The method of Claim 11, wherein said at least one tone curve parameter
2 includes a slope parameter and a shift parameter and wherein said at least one current image
3 statistic includes a current L^* standard deviation and one of a current mean L^* value or low
4 and high L^* percentile values.

1 [C16] 16. The method of Claim 15, wherein said at least one perceptual preference
2 includes a desired L^* standard deviation and one of a desired mean L^* value or a centering
3 function, calculating said at least one tone curve parameter further comprising:
4 calculating said slope parameter using said current L^* standard deviation and
5 said desired L^* standard deviation; and
6 calculating said shift parameter using either said current mean L^* value and
7 said desired mean L^* value or said low and high L^* percentile values and said centering
8 function.

1 [C17] 17. The method of Claim 16, wherein calculating said at least one tone curve
2 parameter further comprises:

3 setting said shift parameter to be equal to an upper pre-selected shift value
4 when said current mean L^* value is less than an upper pre-selected mean L^* value
5 associated with said upper pre-selected shift value and said calculated shift parameter is less
6 than said upper pre-selected shift value; and

7 setting said shift parameter to be equal to a lower pre-selected shift value when
8 said current mean L^* value is greater than a lower pre-selected mean L^* value associated
9 with said lower pre-selected shift value and said calculated shift parameter is greater than said
10 lower pre-selected shift value.

1 [C18] 18. The method of Claim 15, wherein generating further comprises:

2 generating first and second pre-calculated tone curves prior to said step of
3 receiving said digital image data, said first pre-calculated tone curve having a minimum slope
4 and said second pre-calculated tone curve having a maximum slope.

1 [C19] 19. The method of Claim 18, wherein generating said tone curve used in mapping
2 said digital image data onto the range of said output device comprises:
3 interpolating between said first and second pre-calculated tone curves using
4 said slope parameter to obtain an initial tone curve; and
5 shifting said initial tone curve on the X-axis using said shift parameter to
6 produce said tone curve used in mapping said digital image data onto the range of said output
7 device.

1 [C20] 20. The method of Claim 11, wherein generating said tone curve comprises:
2 applying gamma correction to the Y-axis of said tone curve; and
3 converting the X-axis of said tone curve to the scale of said digital image data.